

Effect of Bar-code Technology on the Incidence of Medication Dispensing Errors and Potential Adverse Drug Events in a Hospital Pharmacy

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Abstract: We performed a direct observation pre-post study to evaluate the impact of barcode technology on medication dispensing errors and potential adverse drug events in the pharmacy of a tertiary-academic medical center. We found that barcode technology significantly reduced the rate of target dispensing errors leaving the pharmacy by 85%, from 0.37% to 0.06%. The rate of potential adverse drug events (ADEs) due to dispensing errors was also significantly reduced by 63%, from 0.19% to 0.069%. In a 735-bed hospital where 6 million doses of medications are dispensed per year, this technology is expected to prevent about 13,000 dispensing errors and 6,000 potential ADEs per year.

Background: Many medication dispensing errors occur in hospital pharmacies and a considerable number of these errors have the potential to harm patients by causing adverse drug events (ADEs)¹. To address this patient safety concern, the Food and Drug Administration has mandated bar-coding of all medications used in hospitals by 2006, and some hospital pharmacies are beginning to deploy bar-code technology. However, empiric data supporting the efficacy of this technology to reduce dispensing errors remain limited.

Methods: We conducted a prospective study in the hospital pharmacy at a 720-bed tertiary academic medical center. Using direct observation techniques, we measured the incidence of medication dispensing errors and potential ADEs (defined as dispensing errors with the potential to cause patient harm) before and after the deployment of bar-code technology in the dispensing process. Before deployment ('pre' period), the selection of medication and verification of accuracy were performed manually by pharmacy staff. After deployment ('post' period), each medication dose was bar-coded and electronically scanned to verify its accuracy. During both observation periods, a trained observer visually inspected medications after completion of the dispensing process to identify dispensing errors. Wrong medication, wrong dose/strength, wrong form and expired medication errors were considered target

dispensing errors. Each dispensing error was further reviewed by a 2-physician panel to determine whether it represented a potential ADE.

Results: In the 5-month 'pre' and 4-month 'post' periods, we observed 115164 and 253,984 medication doses respectively. In the pre-barcode period, 0.37% of the doses dispensed from the pharmacy had target dispensing errors, compared to 0.06% in the post-barcode period, representing an 85% relative reduction in the target dispensing error rate (chi-squared test, $p < 0.0001$). The rate of all dispensing errors was reduced by 30% (chi-squared test, $p < 0.0001$). There was a 63% relative reduction in potential ADEs (0.19% in the pre-period, compared to 0.069% in the post-period, chi-squared test, $p < 0.0001$). Of the potential ADEs in the 'post' period, the two most common medication types were electrolytes (44%) and antibiotics (24%); 77% of these potential ADEs were associated with pre-mixed intravenous medications. Errors detected in the post-barcode period were attributable to work-arounds, many of which have been addressed through software modifications and workflow redesign.

Conclusions: Bar-code technology significantly reduced the rate of dispensing errors and potential ADEs due to dispensing errors. In the study pharmacy alone, where nearly 6 million doses of medications are dispensed per year, barcode technology is expected to prevent about 13,000 dispensing errors and 6,000 potential ADEs per year. Further reductions in dispensing errors and potential ADEs should be possible, especially in dispensing processes involving pre-mixed intravenous medications. Overall, our results suggest that bar-code technology can have a substantial impact on serious errors and deserves strong consideration as a tool to improve patient safety.

Reference:

1. Cina J, Gandhi TK, Churchill W et al. Incidence and Severity of Medication Dispensing Errors in a Hospital Pharmacy. *Jt Comm J Quality & Pt Safety*, [in press]